A Taxonomy of Digital Service Design Techniques

Research-in-Progress

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Abstract

In a digital world, service designers need to apply design techniques to meet increasing user expectations. While there are many design techniques out there, the current taxonomies of design techniques provide little guidance for designers when it comes to selecting appropriate design techniques during the design process. Hence, a well-structured taxonomy is needed. This research-in-process seeks to apply a taxonomy development method to classify design techniques and to identify important dimensions in order to provide an overview of digital service design techniques. Our preliminary results present a taxonomy with five dimensions, each of which includes mutually exclusive and collectively exhaustive characteristics. In future research, we plan to evaluate the usefulness of our taxonomy and compare our taxonomy with those that are currently available. Furthermore, we expect to look into the potential interrelations among the dimensions and build a model that explains and predicts the appropriate techniques for a given situation.

Keywords: Digital services, design techniques, taxonomy

Introduction

Given the current trend of digitalization, which is having an impact on government spending (Boyd 2016) and strategic decision making (Hess et al. 2016), companies need design experts to produce extensive insights about users, deliver services in real-time, improve service offerings, and respond to users' increasing needs (Lerch and Gotsch 2015; Miettinen et al. 2014; Rich 2015). However, it is challenging for organizations to adapt rapidly to the digital trend because users are becoming more and more autonomous and expect greater service transparency (Slaats 2013). Although there are many design techniques for

designers,[1] selecting the appropriate design techniques remains a challenge (Burns et al. 2014). Hence, we need to understand design techniques and their selection during the design of digital services in greater depth. A digital service is a service that is "obtained and/or arranged through a digital transaction (information, software modules, or consumer goods) over Internet Protocol" (Williams et al. 2008, p.506). In forging this definition, Williams et al. (2008) emphasize the importance of user interaction in digital service design processes. A taxonomy of digital service design techniques can help designers to select and adopt the correct design technique when they design digital services to respond to users' needs (Lutters et al. 2014). For example, when a digital service is launched, designers can choose a technique (e.g., automated remote test) from the taxonomy to track users' emotional change.

Research on digital service design often takes one of two perspectives. Design is seen either as the result that is to be evaluated or a process that helps us to achieve such an outcome. A great deal of research relates to evaluating digital services design. Examples include the combination of think-aloud with eye movement in order to evaluate e-commerce website design (Goh et al. 2013); the evaluation of the user experience (UX) of cross-platform web services design (Väänänen-Vainio-Mattila and Wäljas 2009); and the development of evaluation criteria for service networks design (Becker et al. 2013). Yet, these methods are not widely used by practitioners because the latter are yearning for guidance regarding the design process (Gray 2016). In order to improve the design process, practitioners benefit from different design techniques (Lutters et al. 2014). While research suggests plenty of design techniques, little research is available that seeks to understand in greater depth the commonalities and differences between such techniques (Oulasvirta and Hornbæk 2016). The examples found in literature offer mixed results and little evidence of their conceptualization (e.g., Martin and Hanington 2012; Rajeshkumar et al. 2013; Vermeeren et al. 2010). In addition, digital service design processes are highly iterative (Buchanan and McMenemy 2012) and interactive (Williams et al. 2008), which further adds to the complexity. Thus, it is challenging for designers to select the appropriate design technique based on certain conditions.

The literature presents us with an increasing number of studies focusing on the introduction to and explanation of specific design techniques to solve design problems (e.g., Akkil and Isokoski 2016; Boy et al. 2015; Cartwright and Pardo 2015). Despite many design techniques being available, little research has been conducted to classify design techniques and therefore help designers to select the right design techniques for a particular design problem (e.g., Martin and Hanington 2012; Rajeshkumar et al. 2013; Vermeeren et al. 2010). In prior research, we find three areas that can lead to improvement. *First*, identify and develop a clear taxonomy (i.e., a set of dimensions). Each dimension consists of a set of two or more mutually exclusive and collectively exhaustive characteristics, such that each object (i.e., design technique) has one and only one characteristic for each dimension (Nickerson et al. 2010, 2013). Taxonomies are widely used in different domains. For example, in biological research, taxonomies play a significant role in classifying the complex nature of the living world (Sokal and Sneath 1963). In web search, taxonomies are used to classify web content (Broder 2002). A taxonomy grounds a foundation, makes it easier to cope with complexity, and helps designers understand design techniques. *Second*, define central terms and be concise in their use. Prior literature seems to use the terms "design methods," "design techniques," and "design tools" either interchangeably or by applying varying meanings to each term. Based on method engineering (Brinkkemper 1996), a design method is a guideline for designers to test design results; a design technique is a set of design steps and activities; and a design tool is a specific software, template, device, etc. As design techniques describe sets of specific steps in design processes (Karimi 1988; Kettinger et al. 1997), they are connections between design methods and design tools. *Third*, clearly introduce and articulate the underlying research methods for classifying the dimensions so that results are transparent and reproducible (Bittner and Leimeister 2014). Following an empirical-to-conceptual approach (Nickerson et al. 2010, 2013), we adopt a taxonomy development method. Hence, this research study focuses on developing a taxonomy to guide designers choosing an appropriate digital service design techniques during design processes. In so doing, we seek an answer to the following research question: *How to classify digital service design techniques into a taxonomy?*

This research aims to deliver theoretical and practical contributions. With respect to the theoretical contributions, we first distinguish design techniques from design methods and design tools and classify digital service design techniques into a taxonomy in order to point out the similarities and differences

[1] In this research-in-progress, the term "designers" covers both design experts and design enthusiasts.

between the design techniques, which can be regarded as a theory for analyzing (Gregor 2006). Second, we identify five dimensions in the taxonomy; these can be regarded as comprehensive and parsimonious constructs in a complete theory (Whetten 1989). Third, after organizing digital service design techniques into a taxonomy metrics, we note the potential interrelations among the dimensions, which act as a foundation to analyze the structure of the taxonomy and to mold a theory for analyzing into a theory for explaining and predicting (Gregor 2006). Developing a theory for predicting addresses the challenge of building a model for designers to understand design practices in depth (Vermeeren et al. 2010). Practical contributions include the taxonomy of digital service design techniques, which is a useful tool to help designers have a comprehensive overview of all available design techniques in digital service design processes in a structured way. A second contribution is that the taxonomy is a foundation for designers to choose and use the appropriate design techniques under different situational constraints.

Background

Digital Services

A broad definition of digital service design conceptualizes the term along four design dimensions (service delivery, malleability, pricing/funds, and service maturity) and three design objectives (business, interaction, and technology) (Williams et al. 2008). During the process of conceptualization, a lot of attention is paid to user interaction. Because of the digital transaction, digital services become more visible and interactive (Williams et al. 2008). Multiple well-designed digital touchpoints in service systems can enhance visibility and interactivity. New opportunities and challenges in digital innovation, such as embedding digitalized products into traditional services, need designers to develop new knowledge to better meet users' needs (Barrett et al. 2015; Yoo et al. 2010). Hence, when conducting design activities in digital service design processes, it is important to consider numerous factors relating to user interaction, for example, service visibility, user behavior, co-creation, etc. (e.g., Lou et al. 2012; Lusch and Nambisan 2015; Williams et al. 2008). In digital service design processes, designers have greater access to design and evaluate digital services. For example, some experiments can be conducted online (e.g., through eyetrack, mouse track, etc.), and designers can obtain more relevant sources to collect user feedback. The broad access to design techniques and end-user feedback is built on digitalized service systems (Brenner et al. 2014; Olphert and Damodaran 2007). While most e-service studies emphasize technological factors, such as privacy protection, service delivery, and costs (e.g., Ba and Johansson 2008; Jin and Oriaku 2013; Yun Kyung Cho and Menor 2010), others mention usability and user experience (e.g., Cronholm 2010; Kuang and Yang 2011; Nosseir and Terzis 2011). Hence, the terms "digital services" and "e-services" are often used interchangeably (e.g., Heinonen 2010; Rowley 2005; Xue et al. 2003, 2005). In this study, we regard these two terms as synonyms and will use only the term "digital services."

Design Methods, Design Techniques, and Design Tools

A clear understanding of the underlying definitions of methods, techniques, and tools is required as a conceptual foundation for creating a taxonomy because vague definitions cause overlaps among the characteristics in each dimension. A method is an approach with a systematic way of thinking and specific rules (Brinkkemper 1996); such an approach combines techniques and tools to address design objectives (Sanders et al. 2010). A technique is a procedure that embodies the representation of design development and procedural aspects (Brinkkemper 1996), including a set of very specific steps to follow in order to achieve the desired outcome (Karimi 1988; Kettinger et al. 1997). Techniques can be sorted, categorized, and prioritized based on the notation's degree of formality (Brinkkemper 1996; Sanders et al. 2010). A tool supports a part of a development process (Brinkkemper 1996). It can be a software package or an instrument to support one part of a technique (Palvia and Nosek 1993).

With regard to the definition of these three terms in design processes, a design method is regarded as a guideline for designers to test their design; a design technique indicates a set of steps and activities during the design procedure; and a design tool is a specific software, template, device, etc. We present the relationship between these three terms and provide corresponding examples for each term in Figure 1. Design techniques are more specific than design methods and more general than design tools. After selecting the appropriate design techniques, designers have a limited number of design tools to choose from and have a specific guide to follow. For example, when choosing affinity diagramming in the design

planning stage (Harboe and Huang 2015), it is necessary to select a tool such as Trello to draw a diagram (Judge et al. 2008), and to follow a design method such as User-Centered Design in order to have a concrete, explicit, and shareable work procedure (Gray 2016; Vredenburg et al. 2002).

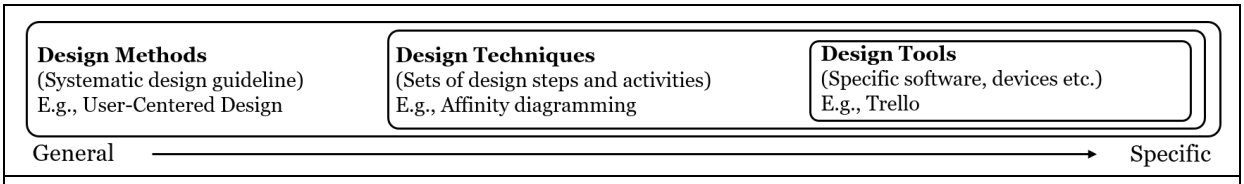

Figure 1. Design Methods, Design Techniques, and Design Tools

Classifying Design Techniques

The literature uses the term "characteristics" to describe the features of classified organisms represented in a taxonomy (Sokal and Sneath 1963). When a taxonomy is applied to the information systems (IS) domain, characteristics can be explained as features that reflect the similarities and differences between objects (i.e., design techniques) (Nickerson et al. 2010). Overlaps between characteristics are regarded as weaknesses of the taxonomy (Bailey 1994). Hence, in order to understand the situated use of digital service design techniques, it is necessary to investigate the selection processes of design techniques in different situations (Gray 2016).

Some studies focus on the classifications of design techniques, which are usually mixed with design methods and design tools. For example, a taxonomy of six dimensions is introduced to classify 100 User-Centered Design techniques (Martin and Hanington 2012). However, a detailed explanation of the classification method is not included in this study. Another research study conducts a survey with designers to collect 96 UX design methods and to classify them in seven dimensions (Vermeeren et al. 2010). Rajeshkumar et al. (2013) analyze the taxonomy of Vermeeren et al. (2010) and develop a taxonomy with five dimensions. These three studies adopt inductive methods to develop taxonomies. After merging the same dimensions, we summarize 11 different dimensions in the three studies (Table 1): Design Phases (DP), Content Types (CT), Data Types (DT), Methods Sources (MS), Primary Purposes (PP), Study Types (ST), Duration (D), Participants (P), Applications (A), Requirements (R), and Evaluation Types (ET).[2]

Table 1 provides an overview of prior classifications and their presented dimensions. The most typical dimensions are Design Phases, Data Types, Study Types, Duration, Participants, and Evaluation Types. Design Phases and Data Types are more commonly captured (Martin and Hanington 2012; Rajeshkumar et al. 2013; Vermeeren et al. 2010). Design Phases are regarded as the starting point and act as a precondition before there is any decision on the design techniques (Andre et al. 2003; Dorst and Cross 2001; Lutters et al. 2014). Data Types are considered during the evaluation and analysis stages. Given an overlap in this dimension (Hyrskykari et al. 2008), it is not a prerequisite when choosing design techniques (Feldon and Kafai 2008). For example, think-aloud protocol includes both quantitative and qualitative data. All three studies emphasize design types because their definitions of design techniques and design tools overlap (Brinkkemper 1996). Between 2010 and 2013, the number of dimensions in these three taxonomies decreased, which means the taxonomy becomes more concise and more useful for designers to choose design techniques (Nickerson et al. 2013). However, overlaps in each dimension still remain. For example, AttrakDiff can be applied to field study and lab study in Study Types. The overlaps hinder the development of a model that explains and predicts the selection of design techniques, which are regarded as a weakness of the taxonomy (Bailey 1994). Additionally, the overlaps add confusion to the selection process. For example, if designers take Data Types as a selection dimension and choose techniques for quantitative studies, they will probably arrive at many techniques that can generate these two types of data, and some of them will be better suited to analyzing qualitative data (e.g., Emocard, UX curve, etc.). Often, interrelations among the dimensions remain unclear. For example, besides considering Design Phases as the preconditions (Dorst and Cross 2001; Lutters et al. 2014), designers also need to consider a broader set

2. The terms in the original articles are not always exactly the same ones we use here. In some cases, based on the description and definition of these dimensions, we use synonyms of the original terms in order to synthesize and compare the existing dimensions with each other more clearly.

of factors during the design processes, such as Duration, Participants, and Evaluation Type, before deciding which design techniques to choose (Roto et al. 2009). In our research, we take the potential interrelations into consideration.

Table 1. Dimensions of Design Techniques in Existing Taxonomies

Studies	*DP*	*CT*	*DT*	*MS*	*PP*	*ST*	*D*	*P*	*A*	*R*	*ET*
Vermeeren et al. 2010	x		x			x	x	x	x	x	x
Martin and Hanington 2012	x	x	x	x	x						x
Rajeshkumar et al. 2013	x		x			x	x	x			

Research Method

Overall, we seek to develop a taxonomy. A taxonomy and its dimensions can be regarded as an artifact in the design science research paradigm (Hevner et al. 2004; March and Smith 1995). We follow a seven-step method to develop a taxonomy of digital service design techniques, and we have four reasons for doing so (Nickerson et al. 2013). First, this method focuses on (but is not limited to) developing taxonomies in the IS domain. For example, Prat et al. (2015) create a taxonomy of evaluation methods for IS artifacts by applying this taxonomy development method. Second, specifying a meta-characteristic at the beginning of the taxonomy development process provides a basis for the choice of dimensions in the taxonomy. Third, the subjective and objective ending conditions act as measures to determine when to terminate the iteration. Fourth, detailed steps are introduced to guarantee that all the characteristics in each dimension are mutually exclusive and collectively exhaustive. The structure in Figure 2 presents the taxonomy development method by Nickerson et al. (2013). The background in gray indicates the research steps we recommend to create a taxonomy of digital service design techniques.

The first step was to determine a meta-characteristic, namely to help designers have an overview of design techniques in the domain of digital service design.

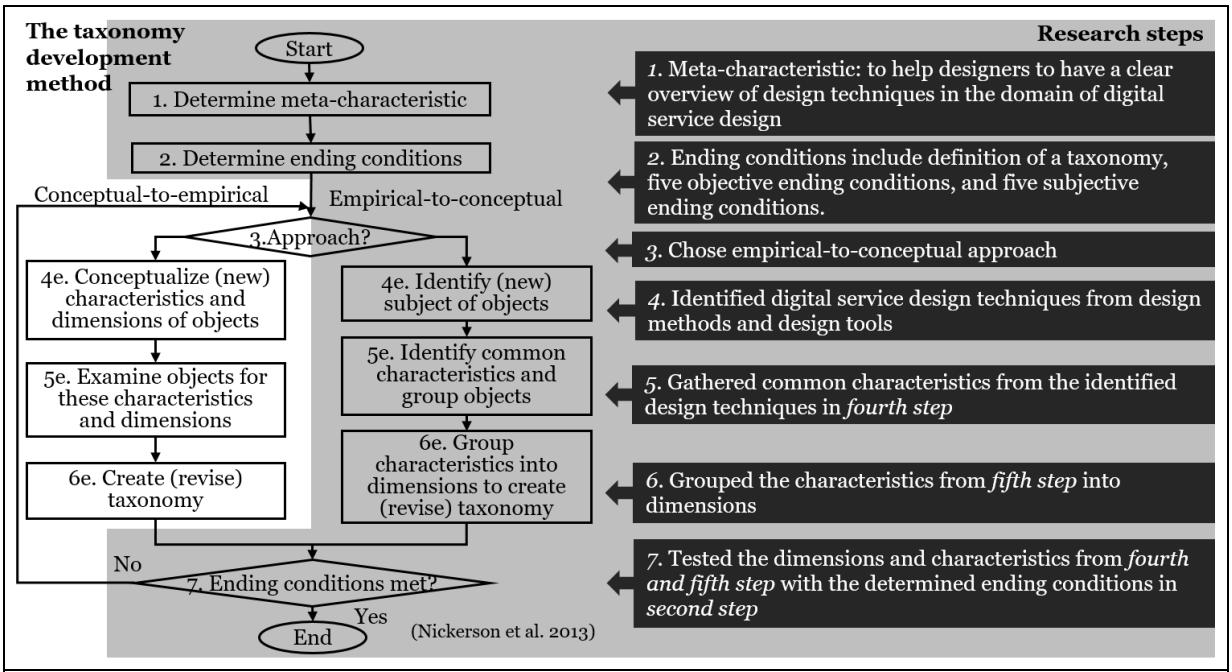

Figure 2. Method for Developing a Taxonomy of Design Techniques

The second step was to define the ending conditions that are used to terminate the iteration in the taxonomy development procedure. There are three types of ending conditions (Nickerson et al. 2010, 2013). The

definition of taxonomy is the basic requirement of our taxonomy. Objective ending conditions evaluate whether characteristics in each dimension are mutually exclusive and collectively exhaustive. Subjective ending conditions are used to check whether it is a useful taxonomy. To test the taxonomy with these ending conditions systematically and purposefully, we organized the applicable ending conditions in our research in Table 2 that present the applied ending conditions in each step (cf., Prat et al. 2015). The detailed steps include identifying design techniques (fourth step) and characteristics (fifth step) and grouping characteristics into dimensions (sixth step). To ensure that the judgment of the subjective ending conditions is unbiased, three researchers evaluated the subjective ending conditions together.

Table 2. Ending Conditions for Developing a Taxonomy of Digital Service Design Techniques

Ending conditions	*Steps*
Definition of a taxonomy	
A taxonomy consists of a set of dimensions. In each dimension, the characteristics are mutually exclusive and collectively exhaustive.	5, 6
Objective ending conditions	
All design techniques have been examined and cannot be merged or split.	4
At least one design technique is classified under each characteristic.	4, 5
Each characteristic is unique and cannot be repeated (no characteristic duplication).	5
Each dimension is unique and cannot be repeated (no dimension duplication).	6
No new dimensions or characteristics can be added in the last iteration.	5,6
Subjective ending conditions	
Concise: The number of dimensions is neither unwieldy nor overwhelming.	6
Robust: There are enough dimensions and characteristics to classify the design techniques.	5, 6
Comprehensive: All design techniques should be classified within the taxonomy.	4, 5, 6
Extendible: A new design technique, characteristic, and dimension can easily be added.	4, 5, 6
Explanatory: The dimensions and characteristics can explain design techniques.	5, 6

In *the third step*, we chose the empirical-to-conceptual approach. We suggested identifying constructs (i.e., dimensions). Given the number of available design techniques, the empirical-to-conceptual approach was deemed to be more suitable. Furthermore, the "bottom-up" approach encourages a systematic and detailed analysis of the data (Myers 2009).

The fourth step focused on identifying the digital service design techniques from our data sources. In order to identify design techniques, we distinguish each data point and select one from the three terms, i.e. design techniques, design methods or design tools (Figure 1). During the first iteration, we gathered all the data points from four sources[3] providing lists and detail explanations of each entry. Those sources[4] that only include links to online tools or software are excluded. After filtering all the repeated definitions, we had a list with 207 data points. First, because the definitions of design tools are most obvious, we excluded all design tools (e.g., software, instruments, checklists, templates, etc.) and obtained a list with 144 design methods and design techniques. We read all the definitions of each data point very carefully and excluded design methods, reaching a list with 69 design techniques. In the second iteration, we filtered the design techniques again by following three steps: First, we filtered the techniques that can only be applied to design physical products. Second, if two techniques had similar definitions, we chose the more widely used one. For example, we chose role-play instead of body storming. Third, when a technique had evolved from a previous version, we chose the latest version. For example, we chose affinity diagramming instead of KJ

3. Four sources: i) usability.gov is a leading resource for UX practices and introduces 53 design and evaluation methods; ii) allaboutux.org is the result of a survey conducted by Vermeeren et al. (2010) that provides a list of 84 evaluation methods; iii) servicedesigntools.org introduces 36 tools from the Research & Consulting Center of Domus Academy; and iv) *Universal Methods of Design* (Martin and Hanington 2012) is a reference book that includes 100 design methods and techniques.
4. For example, uxmastery.com provides links to several online tools but does not include any detailed introduction for each tool; servicedesigntoolkit.org provides design templates but offers no guidance regarding specific design steps.

technique. In the end, the number of design techniques decreased to 55. Three authors conducted the filtering processes together in order to avoid bias.

The fifth step was to gather all the characteristics of the 55 unique design techniques. Since not all of the characteristics were directly presented in the empirical studies, we summarized the descriptions of each design technique into different characteristics by applying an open-coding technique (Corbin and Strauss 2015). The process of open coding was exploratory and led to concept identification, which served our purpose. Two examples of our coding results were short-term (episode, momentary, short test task, short time period, minutes, hours) and real-time (seconds, immediate, video recording, observation, concurrent).

The sixth step was to group all the characteristics from the fifth step into dimensions. In this step, we summarized all the characteristics and put them into five dimensions (Table 3). Four dimensions (Design Phases, Duration, Participants, and Evaluation Types) correspond to the most popular dimensions from previous studies (Table 1). We added Time Dependency (real-time feedback and retrospective feedback) as a new dimension because we noticed that many empirical studies emphasize real-time feedbacks and retrospective feedbacks as two essential characteristics in digital service design processes when identifying design techniques. Hassenzahl and Ullrich (2007) argue that retrospective feedback is an indicator of service quality, while real-time feedback describes users' immediate emotion (Kim et al. 2008), especially when users are interacting with digital services. As a result, Time Dependency also needs to be considered when choosing appropriate design techniques. We exclude Study Types (field study, lab study, and online study) and Data Types (qualitative and quantitative) because their characteristics overlap, and these overlaps may add confusion to designers' selecting processes. For example, UX laddering can be applied in both field study and lab study (Herrmann et al. 2000); and think-aloud protocol includes the analysis of both quantitative and qualitative data (Hyrskykari et al. 2008).

In *the seventh step*, after two iterations, the dimensions and the characteristics met the criteria of the ending conditions (Table 2). In other words, we had developed a useful taxonomy.

Preliminary Results

A Taxonomy of Digital Service Design Techniques

We identify five dimensions to develop a taxonomy of digital service design techniques. Each dimension includes at least two mutually exclusive and collectively exhaustive characteristics. In this research-in-progress, we develop a taxonomy with dimensions (i.e., constructs). Table 3 presents detailed descriptions and explanations of each dimension and characteristic.

Table 3. A Taxonomy of Digital Service Design Techniques

Dimensions	*Characteristics*	
Design Phases are usually regarded as preconditions when choosing design techniques. As digital service design processes are highly iterative, these four steps are conducted in an iteration cycle.	Planning (P)	Design techniques are usually applied to make a plan for an entire design process and to conduct user research.
	Draft Prototyping (D)	Designers make a series of assessments to compare their prototypes with each other to select the appropriate ones.
	Detailed Prototyping (T)	Design techniques focus on evaluating the design works in detail to modify the prototypes to get a stable version.
	Launching (L)	Design techniques concentrate on collecting long-term feedback to help designers to improve digital services further and also to prepare for the next iteration.
Time Dependency discriminates between immediate emotional feedback and feedback based on memory during interaction with digital services.	Real-Time Feedback (RT)	Design techniques are applied to reveal various users' immediate emotional feedback when they interact with digital services.
	Retrospective Feedback (R)	Design techniques indicate the dynamics of emotion based on users' impressions of the experience and the goal achievement of digital services.

Duration is based on the specific time length in an iteration cycle of design processes.	Long-Term Study (LT)	Long-term evaluations demonstrate how relationships between digital services and users evolve over time and the trend of users' satisfaction of digital services, which are often used in the launching stage.
	Short-Term Study (ST)	Short-term studies are usually applied in the early stages of design phases to evaluate dynamic changes in users' needs.
Participants When real users should become involved depends on their roles and design purposes in different design phases.	User Involved (UI)	When real users become involved in design processes, designers can observe, analyze, and predict how well their designed digital services fit users' expectations.
	Without User (WU)	In the planning stage, users sometimes do not know definitively what they want. In this case, using fictitious user profiles is more suitable than getting real users to participate in the design processes.
Evaluation Types The selection of evaluation types should be made in the context of considering other dimensions, such as Time Dependency, Duration, and Participants.	Questionnaire (Q)	Questionnaires indicate users' goal achievement, satisfaction, etc., based on retrospective memory.
	Interview (I)	Interviews generate rich data that reveals users' previous experience and prospect.
	Experiment (E)	Experiments reflect user behavior in a specific environment by means of concrete data.
	Observation (O)	Designers observe user behavior without interrupting the process.
	Group Discussion (GD)	Digital service innovations can be generated by collecting ideas from members of a discussion group, which can also be used as data to supplement designers' observations.

After identifying the techniques and characteristics and grouping them into dimensions, we develop taxonomy metrics with the dimensions and characteristics of digital service design techniques. We put the identified design techniques into the taxonomy metrics to look into the potential interrelations between the dimensions. We start by organizing the techniques that are applicable in the planning phase and have already organized 11 techniques. To date, while we have only organized one-fifth of the 55 techniques that were identified, some potential interrelations have already emerged. Table 4 presents a few examples that demonstrate how one of the taxonomy's roles is to act as a filtering tool to select appropriate design techniques under situational constraints. In Table 4, it is easy to find some interrelations among dimensions. When taking planning (P) and real-time feedback (RT) as two priorities, it is not possible to use questionnaire (Q) and experiment (E) as Evaluation Types. When adding long-term study (LT) as the third constraint, it is impossible for designers to carry out design activities without users in the planning phase. These potential interrelations indicate that a model of dimensions can be built to reflect how these dimensions in the taxonomy influence the selection of design techniques in order to benefit design processes efficiently and effectively.

Table 4. The Taxonomy Metrics for Filtering Design Techniques

Design Techniques	*Design Phases*				*Time Dependency*		*Duration*		*Participants*		*Evaluation Types*				
	P	*D*	*T*	*L*	*RT*	*R*	*LT*	*ST*	*UI*	*WU*	*Q*	*I*	*E*	*O*	*GD*
1. When choosing planning and real-time as two priorities:															
Behavior mapping	x				x			x	x						x
Storyboards	x				x			x		x					x

…	x		x										
Total number	11		11		2	9	7	2	0	2	0	3	6
2. When choosing planning, real-time, and long-term as three priorities:													
Personal inventories	x		x		x		x						x
Photo studies	x		x		x		x					x	
Total number	2		2		2		2	0	0	0	0	1	1
"x" means this characteristic is selected to filter design techniques. "Total number" indicates how many design techniques are left after selection.													

Evaluation of the Taxonomy

We seek to advance this study in three ways, based on the preliminary result. First, we plan to validate the conceptualized dimensions and characteristics in the taxonomy of digital service design techniques by applying the *conceptual-to-empirical* approach (Figure 2) of Nickerson et al. (2013). We will examine dimensions and characteristics in this initial version of the taxonomy (Table 3) by reviewing literature that introduces design techniques that can be used in digital service design processes. Second, we will conduct a survey with designers by using a Likert-agreement scale (Hoehle and Venkatesh 2015) to evaluate the usefulness of this taxonomy. The modified taxonomy will be compared with existing taxonomies to test the applicability and superiority of our taxonomy. Third, we will investigate the interrelations between dimensions and operationalize the dimensions to build a model by applying the confirmatory factor analysis method (MacKenzie et al. 2011). We suggest a framework (Figure 3) to present the interrelations between dimensions by applying an input-process-output (IPO) framework (Bhattacherjee 2012; Camillus and Venkatraman 1984; Palvia and Nosek 1993) and plan to test this current framework with datasets of design consultant companies. Since selecting appropriate digital service design techniques is the purpose of this model, they can be seen as "Output." Design Phases, Time Dependency, and Duration can be regarded as "Input" because they act as preconditions to decide on the usage of design techniques (Dorst and Cross 2001; Lutters et al. 2014). The final decision of design techniques is also influenced by Evaluation Types and Participants in "Process." In our future research, we will analyze the interrelations between these dimensions and how these dimensions influence the selection of design techniques. The framework can be used to explain and predict the selection of the appropriate design techniques under situational constraints.

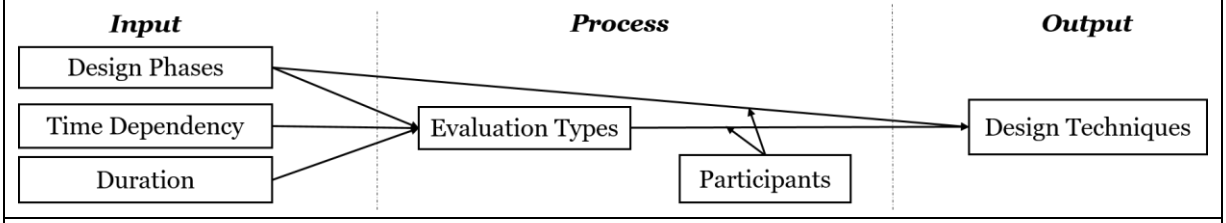

Figure 3. Potential Interrelations between Each Dimension

Conclusion

In this study, we recommend developing a taxonomy of digital service design techniques. The results are expected to provide an overview of design techniques for designers and guide the selection of such techniques. For the development of such a taxonomy, we have to distinguish between design methods, design techniques, and design tools, as their use in the literature is inconsistent. Following an empirical-to-conceptual approach, our preliminary results identify five dimensions with mutually exclusive and collectively exhaustive characteristics of design techniques. Following, we seek to evaluate our taxonomy using a database.

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